Comparative analysis of Young's modulus measurements of grains of alloys 1013 and B-1461 by the SPM method

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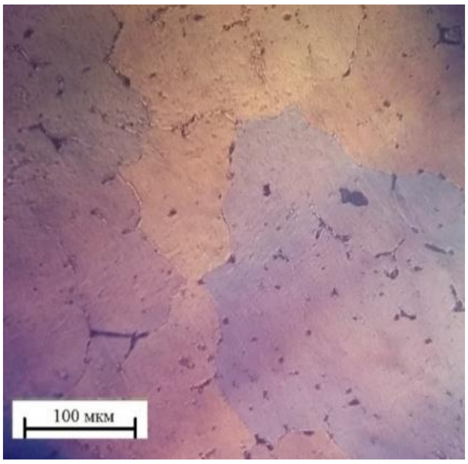
The aim of the work was to carry out a comparative analysis of the series of measurements of Young's modulus of individual grains of samples of two alloys. This comparison was carried out to test the feasibility of applying the technique for determining the crystallographic orientation [1] on various aluminum alloys. The technique itself consists in determining the crystallographic orientation by the color of the grain in polarized light. The crystallographic orientation is determined indirectly through the Young's modulus, measured by the SPM method. Further, the relationship between the color of the grain and its Young's modulus is derived. The dependence of the crystallographic orientation on Young's modulus is described in [2].

The color of the grain depends on the thickness of the oxide film, formed after the preparation of the sample surface. On the surface of alloy 1013, blue, orange and yellow grains are observed. Under the same conditions for surface preparation of samples, the same colors as on the surface of alloy 1013 are observed on the surface of alloy B-1461. The images of the surfaces of alloys are shown in Figure 1.



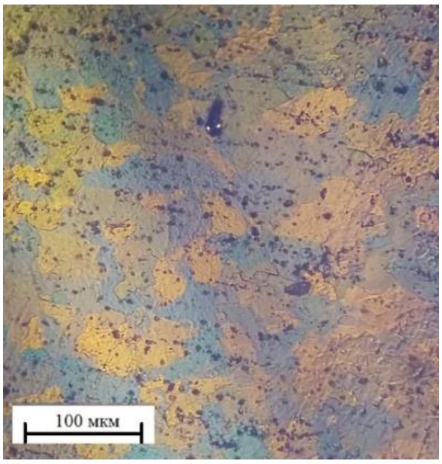


Figure 1. Images of the surfaces of alloys 1013 (left) and B-1461 (right) in polarized light.

When comparing the Young's modulus of the 1013 [1] and B-1461 [3] alloys, carried out with the same calibration of the instrument, it is established that for both alloys the blue grains have a minimum modulus of elasticity, the yellow grains have a maximum modulus of elasticity. Orange grains have intermediate values for both alloys. Also, the data obtained by experimental measurements coincide with the literature data on the Young's modulus, depending on the crystallographic direction for aluminum alloys.

The obtained result allows to draw a conclusion that the previously developed technique for the aluminum alloy 1013 is also applicable to the aluminum-lithium alloy B-1461.

1. Baraev D.I., Chaplygin K.K., sbornik tezisov dokladov Mezhdunarodnoj molodezhnoj nauchnoj konferencii «XLIII Gagarinskie chteniya», Moskva, MAI, 216 (2017)
2. P.G. Miklyaev, YA.B. Fridman, Anizotropiya mekhanicheskih svojstv metallov, M: Metallurgiya, 12 (1986).
3. Voronin S.V., Chaplygin K.K. V-1461, Sbornik materialov XV Vserossijskoj s mezhdunarodnym uchastiem shkoly – seminara po strukturnoj makrokinetike dlya molodyh uchenyh imeni akademika A.G. Merzhanova, 97 (2017)